Docket No.:00124-01080-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Sharon A. Free et al.

Application No.: 10/710,494 Confirmation No.: 4493

Filed: July 15, 2004 Art Unit: 3752

For: LOW DENSITY EXPLOSION SUPPRESSING FOAMS Examiner: Davis D. Hwu

APPEAL BRIEF

MS Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

As required under § 41.37(a), this brief is filed within two months of the Notice of Appeal filed in this case on January 14, 2008, and is in furtherance of said Notice of Appeal.

The fees required under § 41.20(b)(2) are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

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TABLE OF CONTENTS

This brief contains items under the following headings as required by 37 C.F.R. § 41.37 and M.P.E.P. § 1205.02:

I. Real Party in Interest

By virtue of an Assignment executed by the inventors, the real party in interest is Foamex L.P. of Linwood, Pennsylvania, a Delaware limited partnership. Foamex L.P. has as its managing general partner, FMXI, LLC of Linwood, Pennsylvania, a Delaware limited liability company.

II. Related Appeals and Interferences

There are no other appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. Status of Claims

Pending claims:	1, 2, 4-11 and 13-15
Withdrawn claims:	7-11
Allowed claims:	None
Claims objected to:	None
Claims rejected:	1, 2, 4-6 and 13-15.
Claims on appeal:	1, 2, 4-6 and 13-15.

IV. Status of Amendments

On July 12, 2007 the Examiner issued a Final Office Action rejecting the pending claims. Applicants filed an RCE on October 4, 2007, with an accompanying amendment. On October 12, 2007, the Examiner issued a non-final office action again rejecting claims 1, 2, 4-6 and 13-15. Claims 1, 2, 4-6, and 13-15, which have been rejected by the Examiner more than twice, remain pending in the present application and are the subject of this Appeal.

V. Summary of Claimed Subject Matter

The present invention, as stated in independent claim 1, is concerned with a method for suppressing an explosion in a fuel tank, such as due to collisions or crashes, electrical ignition, lightning strikes or static discharge (paragraphs [0002], [0004]). In the claimed method a reticulated polyurethane foam is installed into the tank (paragraph [0008]). To improve performance over prior methods, the reticulated polyurethane foam has a low density (less than 1.0 pounds per cubic foot (16 kg/m^3)), and a volume electrical resistivity of less than 10^{12} ohm-cm at 70 °F (21.1 °C) (paragraphs [0008] and [0009]). One or more antistatic agents are added to a polyol or in situ to a foam-forming mixture used to prepare the reticulated polyurethane foam (paragraphs [0009], [0038] and [0039]). The antistatic agents include quarternary ammonium compounds, quarternary ammonium salts of alkyl sulfuric acid and carboxylic acid, metallic salts of lithium, sodium, potassium, ammonium, calcium and barium, complexes of metallic salts with polyhydric alcohols and their derivatives, such as 1,4 butanediol, ethylene glycol, propylene glycol and polyethylene glycol, complexes of metallic salts with mono-ols, such as ethylene glycol monomethyl ether and ethylene glycol monoethyl ether, hexahalogenated ionic compounds, hexahalogenated phosphate compounds, potassium hexafluorophosphate, sodium hexafluorophosphate, ammonium hexafluorophosphate, and carbon black (paragraph [0039]).

VI. Grounds of Rejection to be Reviewed on Appeal

Has the Examiner established that claims 1, 2, 4-6 and 13-15 are unpatentable under 35 U.S.C. §103(a) over Volz (U.S. Patent No. 4,578,406) in view of MacDonald et al. (U.S. Patent No. 3,822,807) and Spicher (U.S. Patent No. 5,677,357)?

VII. Argument

<u>Claims 1, 2, 4, 5, 6, 13, 14</u>

The Examiner's rejection of claims 1, 2, 4, 5, 6, 13 and 14 as obvious under 35 USC §103 should be reversed.

On April 30, 2007, the Supreme Court of the United States issued its opinion in *KSR International Co.* v. *Teleflex Inc.*, and addressed obviousness under 35 U.S.C. §103(a). The Court did not reject the application of a "teaching, suggestion, or motivation" (TSM) test for obviousness analysis, but rejected a rigid and mandatory use of that test as a limitation of the obviousness inquiry. The Court stated that the TSM test "captured a helpful insight," because a patent composed of several elements "is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art" and "it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does." *KSR International Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741, 82 USPQ.2d 1385, 1402 (2007). The Court further confirmed its opinion in *United States v. Adams,* 383 U.S. 39, 40, 148 USPQ 479, 480 (1966), that "when the prior art teaches away from combining certain known elements, discovery of a successful means of combining them is more likely to be non-obviousness." *KSR,* 127 S. Ct. at 1740.

A prior art reference must be considered in its entirety, *i.e.*, as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied,* 469 U.S. 851 (1984). Also, it is improper to combine references where the references teach away from their combination. *See* MPEP 2145(x)(D)(2). A reference may be said to teach away when a person of ordinary

skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicants. *In re Gurley*, 27 F.3d 551, 553, 31 USPQ.2d 1130, 1132 (Fed. Cir. 1994).

Applicants claim a method for suppressing an explosion in a fuel tank. As set forth in claim 1, the method comprises the step of installing into a tank a reticulated polyurethane foam having (1) a density of less than 1.0 pounds per cubic foot (pcf)(16 Kg/m^3), and (2) a volume electrical resistivity of less than 10^{12} ohm-cm at 70 °F. Such foam further incorporates antistatic agents, which are added <u>in situ</u> in the foam forming mixture, either by adding the antistatic agent(s) to the polyol component or by adding the antistatic agent(s) to the foam-forming mixture at the mix head. The antistatic agents include quarternary ammonium compounds, quarternary ammonium salts of alkyl sulfuric acid and carboxylic acid, metallic salts of lithium, sodium, potassium, ammonium, calcium and barium, complexes of metallic salts with polyhydric alcohols and their derivatives, such as 1,4 butanediol, ethylene glycol, propylene glycol and polyethylene glycol, complexes of metallic salts with mono-ols, such as ethylene glycol monomethyl ether and ethylene glycol monoethyl ether, hexahalogenated ionic compounds, hexahalogenated phosphate compounds, potassium hexafluorophosphate, sodium hexafluorophosphate, ammonium hexafluorophosphate, and carbon black.

Volz discloses reticulated, conductive polyurethane foams having a volume electrical resistivity of less than 10^{13} ohm-cm, which can be installed in fuel tanks to suppress explosions. Applicants acknowledge that the primary reference, Volz, does relate to methods for suppressing fuel tank explosions. However, Volz does ***not*** disclose a method using a foam (1) with a foam density of less than 1.0 pcf, or

(2) having a low volume electrical resistivity by incorporating antistatic additives by ***in situ*** addition.

As to the first difference, Volz does not appreciate the importance of lowering density to performance of the explosion suppressing foam. The only examples set out in Volz prepare a foam with a density above applicants' claimed density. *See, e.g.*, Example 1 at column 5, lines 62 to 65 and Example 4 at column 6, lines 24 to 27, where the foam density is disclosed as 1.3 pcf. Volz does not teach or suggest that lowering the density of these foams would be desirable.

As to the second aspect, nor does Volz teach that in situ addition of chemical additives (antistatic additives) is suitable for foams intended for use in fuel tanks. Quite to the contrary, Volz directs persons of ordinary skill away from in situ addition.

Volz seeks to interpenetrate the foam with a chemical additive, such as a charge agent, after the foam has been formed, and expressly teaches away from in situ incorporation. Volz identifies two ways in which foams may be modified with chemical additives – (1) coating the surface of a foam with a chemical additive, and (2) in situ adding a chemical additive into foam-forming reactants. Col. 1, line 50 to Col. 2, line 2. Volz then notes the significant disadvantages of using in situ addition, and ***directs*** persons skilled in the art ***away*** from in situ combinations of foaming mixtures with antistatic agents: "The disadvantages of in situ incorporation include the possibility that the desired chemical additive, or a carrier for the chemical additive, will react with the polyurethane foam-forming reactants to adversely effect either the chemical additive itself, the properties of the subsequently formed foam, or the processing of the foam. This generally limits both the nature and the amount of chemical additive that can be incorporated into

the polyurethane foam. Another disadvantage is that in situ impregnation is not useful with a volatile or heat-sensitive chemical additive, for the heat of the urethane polymerization reaction will degrade the additive or will volatize and drive the additive out of the foam-forming mixture." Col. 2, lines 3 to 24. Taken as a whole, Volz teaches away from installing into fuel tanks polyurethane foams made by ***in situ*** incorporation with antistatic additives. Thus, one of ordinary skill in the art would have been discouraged from following the path set out in claim 1.

In contrast to Volz's teaching away, claim 1 requires antistatic agents be combined in situ and surprisingly achieves the combination of desired volume electrical resistivity while maintaining the desired low density of the foam and the quality performance. Furthermore, adding a surface coating to an already formed foam, such as taught by Volz, adds weight and would necessarily increase density. Volz failed to appreciate the problems of increased density in the aircraft fuel tank, and failed to direct skilled persons to a solution that would reduce density, and the associated undesirable excess weight in the fuel tank. Applicants seek to improve upon Volz's teaching by making a foam that has a significantly lower density such that the foam can be used in fuel tanks of smaller aircraft and commercial aircraft.

McDonald does not fill all of the gaps in the teaching of Volz. MacDonald installs polyurethane foam balls, which are openly reticulated, into a container (such as a fuel tank) for explosion suppression. MacDonald's foam balls are created from foams with densities from 12 to 30 kg/m^3, preferably from 12 to 15 kg/m^3 (i.e., can be less than 1 pcf). Column 1, line 28 and column 2, lines 14-15. MacDonald does not include any antistatic additives in the foam and does not mention electrical resistivity or any problems encountered with charge build up within the tank. The combination of Volz and MacDonald would not result in the

method set out in claim 1 since neither reference teaches skilled persons to use ***in situ*** antistatic agent addition for foams intended to be installed into fuel tanks.

Spicher has nothing to do with methods for suppressing explosions in fuel tanks. Spicher teaches generally that a hexahalogenated ionic compound can be added to polyurethane foams for electronic packaging. Spicher's general disclosure about hexahalogenated ionic compounds does not rebut Volz's express teaching away from in situ addition of antistatic additives when making a foam for insertion into a fuel tank for suppressing explosions. In fact, Spicher specifically teaches away from ***in situ*** addition of quarternary ammonium compounds into a polyurethane foam. Spicher states that the addition of amine-based quaternary ammonium compounds are not favored in polyurethane foams because amines exhibit moderate to high levels of contact corrosivity and would damage the foams. Spicher also states that quaternary ammonium compounds would affect the polyurethane reactions. See Col. 2, lines 50- 67.

In contrast to Spicher's teaching away, Applicants successfully made and applied polyurethane foams incorporated in situ with quaternary ammonium compounds in fuel tanks for suppressing explosions. Furthermore, Spicher does not disclose a polyurethane foam having a density of less than 1.0 pcf. *See, e.g.*, Example 1 at column 6, line 20 and Example 2 at column 6, line 49, where the foam density is disclosed as 1.5 pcf.

The pending claims should be allowed and the Examiner's rejection should be reversed. As pointed out above, Volz provides no motivation to persons skilled in the art that the reticulated foams taught by Volz would be improved by lowering density, and Volz ***expressly teaches away*** from ***in situ*** incorporation of chemical additives, such as antistatic agents for suppressing explosion in fuel tanks. Spicher

is at best cumulative to Volz insofar as noting that a hexahalogenated ionic compound can be incorporated ***in situ*** into polyurethane foams, but Spicher does not rebut Volz's express teaching away from doing so in a method for suppressing an explosion in fuel tanks. Furthermore, Spicher teaches away in situ incorporation of quaternary ammonium compounds into a polyurethane foam mixture. For its part, MacDonald does show lower density foams, but MacDonald also does not motivate a skilled person to reject the express teaching away from in situ chemical addition set forth in Volz. Therefore, there is no suggestion or motivation for combining Volz, Spicher and MacDonald to encompass claim 1,

Claim 15

The Examiner's rejection of claim 15 as obvious under 35 USC §103(a) over Volz in view of MacDonald and Spicher should be reversed. Pending claim 15 further specifies that the polyurethane foam is foamed under vacuum conditions to achieve a lower density foam. Such foam is then reticulated and used in the method of the invention.

Neither Volz nor MacDonald nor Spicher shows a method in which foam to be installed in a fuel tank is foamed under controlled vacuum conditions. Such foaming conditions make it possible to foam a reaction mix with in situ incorporation of antistatic additives and still achieve a low volume electrical resistivity in combination with a lower resultant foam density. Neither Volz nor MacDonald nor Spicher appreciated this advance. This is another reason to allow dependent claim 15 over the purported combination of Volz, MacDonald and Spicher.

The Examiner misapprehended the scope of claim 15 (characterizing claim 15 as being directed to "a product"). Just as claims 1, 2, 4-6 and 13 and 14 are

method claims (method for suppressing explosion in a fuel tank), claim 15 depends from claim 1 and is also a method claim. Claim 15 includes another method limitation not shown in the purported combination of Volz, MacDonald and Spicher. Pending claim 15 should be allowed and the Examiner's rejection should be reversed.

VIII. Conclusion

In view of the above Argument, the Examiner has erred by rejecting claims 1, 2, 4-6 and 13-15. Accordingly, it is requested that the Board reverse the Examiner's rejection and allow claims 1, 2, 4-6 and 13-15.

Dated: January 30, 2008

Respectfully submitted,

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APPENDIX 1

Claims Involved in the Appeal of Application Serial No. 10/710,494

1. A method for suppressing an explosion in a fuel tank, comprising: installing into the tank a reticulated polyurethane foam having a density less than 1.0 pounds per cubic foot (16 kg/m^3), and having a volume electrical resistivity of less than 10^{12} ohm-cm at 70°F (21.1°C), wherein one or more antistatic agents is added to a polyol or in situ to a foam-forming mixture used to prepare the reticulated polyurethane foam, such antistatic agents being selected from the group consisting of: quarternary ammonium compounds, quarternary ammonium salts of alkyl sulfuric acid and carboxylic acid, metallic salts of lithium, sodium, potassium, ammonium, calcium and barium, complexes of metallic salts with polyhydric alcohols and their derivatives, such as 1,4 butanediol, ethylene glycol, propylene glycol and polyethylene glycol, complexes of metallic salts with mono-ols, such as ethylene glycol monomethyl ether and ethylene glycol monoethyl ether, hexahalogenated ionic compounds, hexahalogenated phosphate compounds, potassium hexafluorophosphate, sodium hexafluorophosphate, ammonium hexafluorophosphate, and carbon black.

2. The method of claim 1, wherein the polyurethane foam has a density of from 0.6 to 0.9 pounds per cubic foot [9.6 to 14.4 kg/m^3].

4. The method of claim 1, wherein the polyurethane foam is reticulated by thermal reticulation.

5. The method of claim 1, wherein the tank has an inner volume and the foam fills from 50 to 90% of the inner volume of the tank.

6. The method of claim 1, wherein the fuel tank is an aircraft fuel tank.

13. The method of claim 1, wherein the antistatic agents is/are metallic salts.

14. The method of claim 1, wherein the antistatic agents is/are added in amounts from 0.1 to 20 parts per hundred parts polyol.

15. The method of claim 1, wherein the foam-forming mixture used to prepare the reticulated polyurethane foam is foamed under controlled vacuum conditions from 0.6 to 0.95 bar (absolute).

APPENDIX 2

Evidence.

None.

APPENDIX 3

Related Proceedings.

None.